

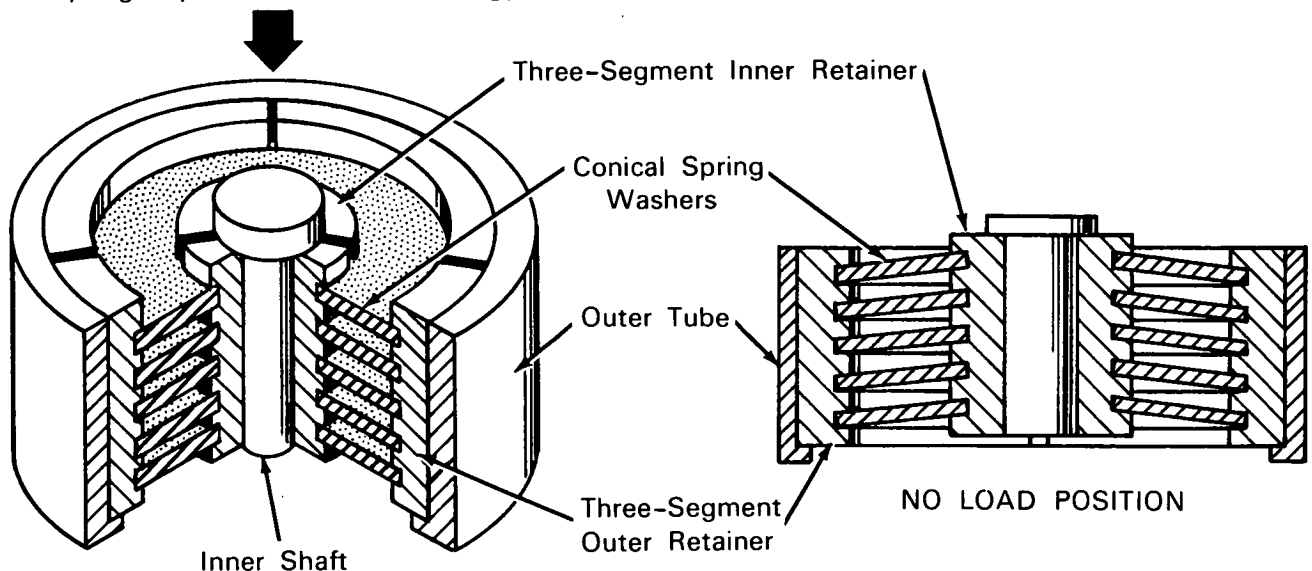
NASA TECH BRIEF



This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

New Package for Belleville Spring Permits Rate Change, Easy Disassembly

Spring Depresses to Absorb Energy



The problem: To effect basic improvements to the Belleville spring package so that the spring washers can be added or taken out to vary the spring rate and still provide non-linear characteristics. Standard designs have undesirable hysteresis effects and present problems in inserting or removing washers.

The solution: A new kind of spring package that has grooves to hold the spring washers at both the inner and the outer edges. Hysteresis, or lag effects are reduced to a minimum. Three-segment retainers permit easy disassembly so that the spring rate can be changed.

How it's done: Key elements of the improved spring package are the grooved, three-segment, inner and outer retainers. The segmented retainer permits

the spring package to be quickly assembled or disassembled. The inner edge of each conical spring washer is held in a groove of the inner segmented retainer. A shaft fits into the central axis of the retainer to hold it in place.

Outer edges of the conical springs are held by grooves in the outer retainer, also made in three segments for easy disassembly. Segments are held in place by the outside tube which surrounds the outer retainer.

In standard designs the outer radius of the last spring washer and the inner radius of the first spring carry the entire load. Forces are concentrated at the periphery of the washer, resulting in plastic deformation and large hysteresis effects.

(continued overleaf)

Since both inner and outer edges of the spring washers in this innovation are held by the grooves of the two retainers, each spring flexes the same amount and carries the same proportion of the load. Spring washers can easily be removed or added to effect a change in the spring rate or spring characteristics. The spring package is disassembled by first removing the outer tube and taking out the outer grooved retainer, then the center shaft, and finally the inner retainers.

Notes:

1. Although this innovation was designed as a high-pressure regulator in a space vehicle, it would have value in any machine where space is limited or where the required helical spring would have a

small index (ratio of coil spring diameter to the diameter of the wire).

2. Other uses of this device could be the popoff valve of a boiler. Action of the spring results in extremely high tension with very slight movement.

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